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U.S. Army
Environmental
Center

FORT DEVENS
FEASIBILITY STUDY
FOR GROUP 1A SITES

FINAL
GROVE POND SITE INVESTIGATION
WORK PLAN
DATA ITEM A004

CONTRACT DAAA15-91-D-0008

U.S. ARMY ENVIRONMENTAL CENTER
ABERDEEN PROVING GROUND, MARYLAND

FEBRUARY 1995

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CONTRACT NO. DAAA15-91-D-0008
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Prepared for:

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland

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Project No. 07005-01

FEBRUARY 1995

GROVE POND SITE INVESTIGATION WORK PLAN
FORT DEVENS, MASSACHUSETTS

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1.0 INTRODUCTION

ABB Environmental Services, Inc. (ABB-ES), prepared this Work Plan in accordance with U.S. Army Environmental Center (USAEC, formerly U.S. Army Toxic and Hazardous Materials Agency) Contract DAAA15-91-D-0008, Delivery Order 0004, for conducting environmental investigations at Group 1A sites at Fort Devens, Massachusetts. Field investigations conducted in 1993 during the Feasibility Study (FS) for Group 1A sites included preliminary sampling along the western shore of Grove Pond to assess the presence or absence of contamination and the potential for Grove Pond to be or to have been a source of contaminants to Plow Shop Pond located downstream. Five pond sediment and surface water sample pairs were collected from the shoreline area. Chemical analysis results showed sediment contamination with several semivolatile organic compounds (SVOCs), pesticides, and inorganics. Human health and ecological risk assessments were not conducted; however sediments, particularly those in the northwest cove, appeared heavily contaminated with arsenic, chromium, lead, mercury, and other inorganics (ABB-ES, 1993b). Surface water did not appear to be heavily contaminated. Figure 1 shows the geographic location of Grove Pond in relation to Fort Devens.

1.1 Purpose and Scope

The purpose of this work plan is to provide a basis and plan for collecting and interpreting data on the presence and distribution of contamination in Grove Pond. The upland, wetland, and aquatic ecosystems at Grove Pond will be characterized and human health and ecological preliminary risk evaluations (PREs) will be performed to provide screening level evaluation of potential risks.

1.2 Site Description

Grove Pond is a shallow, 60-acre pond located outside the installation boundary at the northeast corner of the Main Post at Fort Devens. Grove Pond is the fifth in a chain of six ponds (Long Pond, Sandy Pond, Flanagan Pond, Balch Pond, Grove Pond, and Plow Shop Pond) in the Town of Ayer. It also receives the discharge of Cold Spring Brook which originates in the Town of Harvard. The

western shore of Grove Pond is formed by a railroad causeway constructed in the 1800's. A stone arch culvert under the causeway connects the pond with downstream Plow Shop Pond (Figure 2).

The waters of Grove Pond are designated as Class B by the Commonwealth of Massachusetts. The pond is eutrophic, and seasonally supports dense growths of aquatic macrophytes. The majority of the pond bottom is likely similar to the bottom of Plow Shop Pond which consists primarily of highly organic sediments and peat up to several feet thick. A potion of the pond bottom in the northwest cove consists of a clayey, possibly fill, material. Water elevation in Grove Pond is controlled at approximately 216 feet above sea level by a dam located at the outlet of Plow Shop Pond downstream.

The pond is roughly triangular in shape with a western shore formed by the railroad causeway, a northern shore bordered by residential, recreational, and former industrial areas of Ayer, and a southern shore bordered primarily by property owned by Fort Devens, the Massachusetts National Guard, and the Town of Ayer.

From 1854 through 1961, the area east of the railroad causeway at the northwest corner of Grove Pond was the site of a tannery (Wilson, 1961a, 1961b) (see Figure 2). The tannery changed ownership several times and operated intermittently between 1900 and 1944. From December 1944 until destroyed by fire in June 1961, this was a successful cattlehide tannery with facilities including a beam-house for hide unhairing and a tan-house for chrome-tanning.

The tannery is of interest because of its waste disposal practices and its potential as a source of contaminants, especially arsenic, chromium, lead, and mercury, to Grove and Plow Shop ponds. Before 1953, process wastewater from the tannery was discharged to Grove Pond with little or no treatment (Fay, 1993; Taylor, 1953; Power, 1957). In addition, a dump was located on tannery property between the tannery and Grove Pond (Fay, 1993; Fillebrown, 1993; Naparstek, 1993). The dump's specific location is suggested by the gradual filling-in of an embayment in Grove Pond as discernable in aerial photographs taken in 1943, 1952, and 1965 (Detrick, 1991, Figures 14, 15, and 16). As early as 1944, the Town of Ayer and the Commonwealth of Massachusetts were concerned about contamination of Grove Pond by the tannery, and in 1949 the town began the process of borrowing funds to connect the tannery to the local wastewater

treatment plant (Town of Ayer, 1950; Wilson, 1961a and b). The connection was completed on April 17, 1953 (Taylor, 1953).

A low-lying wetland area separates the site of the former tannery from Pirone Park, a town owned recreational area located along the north central shore of Grove Pond. Portions of the area appear to be on fill materials and it is reported that landfilling occurred in that vicinity in the past. Residential areas exist north and east of Pirone Park.

The southern shore is less developed than the northern shore. The extreme southwest shore of Grove Pond borders the Hill Yard, an active railyard operated by the Boston & Maine Railroad (B&MRR). Railroad facilities do not extend to the pond shore; however, storm water runoff from the railyard may discharge to the pond. Other potential sources of contaminants include inflow from Cold Spring Brook, inflow from Balch Pond, and runoff from Fort Devens and the Town of Ayer. The Fort Devens Grove Pond well field is located to the east along the southwest shore along with a water treatment building. The Town of Ayer maintains two municipal wells along the southeast shore. Neither Fort Devens or the Town of Ayer currently uses the wells because of concerns about water quality.

The pond is used by area residents for recreational fishing; however,the extensive presence of submerged and floating vegetation makes the pond unattractive for swimming and other water contact activities. Fishermen access the pond from a gravel boat launch area adjacent to Pirone Park, from a unimproved access area on Fort Devens property in the large southwest cove, and by walking along the railroad causeway. Although there is potential for children to play along the shore, particularly in the vicinity of Pirone Park, trees and brush limit accessibility and aquatic vegetation is thick. Several residential lots abut the pond along the northeast shore.

1.3 Summary of Previous and Related Investigations

ABB-ES collected surface water and sediment samples in Grove Pond in December 1992 and January 1993 as part of sampling activities associated with the FS for Group 1A sites (ABB-ES, 1993b). A total of five surface water and five sediment samples were collected (Figure 3). Surface water samples were

analyzed for Project Analyte List (PAL) volatile organic compounds (VOCs), SVOCs, pesticides and polychlorinated biphenyls (PCBs), explosives, inorganics, total organic carbon (TOC), total suspended solids (TSS), total dissolved solids (TDS), alkalinity, and hardness. Table 1 summarizes the analytical results. Except for trichloroethylene at 0.5 micrograms per liter ($\mu g/L$) in sample GRW-92-04X, no PAL organics were reported.

A total of 10 PAL inorganics were detected with the highest concentrations for seven reported in GRW-92-04X (aluminum, 2,960 $\mu g/L$; arsenic, 4.05 $\mu g/L$; barium, 42.3 $\mu g/L$; calcium, 19,700 $\mu g/L$, iron, 841 $\mu g/L$, lead, 6.18 $\mu g/L$; potassium, 2,730 $\mu g/L$). Surface water background concentrations were not available for comparison; however, comparison of the reported values with Ambient Water Quality Criteria (AWQC) for protection of aquatic life revealed that criteria have only been established for four of the detected inorganics: aluminum, arsenic, iron, and lead. No exceedances of AWQC were observed for samples GRW-92-02X and GRW-92-03X. Sample GRW-92-01X exceeded the chronic criteria for lead (2.06 $\mu g/L$ versus 1.3 $\mu g/L$, at an assumed hardness of 50 milligrams [mg] $CaCO_3/L$), but not the acute criteria (34 $\mu g/L$). Sample GRW-92-04X exceeded the chronic and acute criteria for aluminum (2,960 $\mu g/L$ versus 87 and 750 $\mu g/L$, respectively) and chronic criteria for lead (6.18 $\mu g/L$ versus 1.3 $\mu g/L$, assumed hardness of 50 mg $CaCO_3/L$), but not the acute criteria (34 $\mu g/L$). Sample GRW-92-05X exceeded the chronic criteria for lead (4.23 $\mu g/L$ versus 1.3 $\mu g/L$, assumed hardness of 50 mg $CaCO_3/L$). None of the samples exceeded the AWQC of 190 $\mu g/L$ for arsenic.

Based on the above comparisons, it was concluded that surface water in the western end of Grove Pond was not heavily contaminated (ABB-ES, 1993b).

The five shallow sediment samples were analyzed for PAL VOCs, SVOCs, pesticides and PCBs, inorganics, and TOC. Review of the data indicated the presence of the VOC acetone in four of five samples, and the VOC toluene in one sample at concentrations of less than 1 microgram per gram ($\mu g/g$). Toluene was also found in five of 21 rinsate blanks at concentrations up to 4.2 $\mu g/L$, and consequently it was not considered a sediment contaminant. Acetone was also reported in method and rinsate blanks. A total of 10 SVOCs were detected in samples GRD-92-02X, GRD-92-03X, and GRD-92-04X. The greatest number (nine) of SVOCs were reported in GRW-92-04X with a total concentration of 12.8 $\mu g/g$. This distribution of organic contaminants suggested a source upstream

of GRD-92-04X, possibly associated with railroad activities. The SVOC 4-methylphenol was reported at 12 μg/g and 17 μg/g in GRD-92-02X and GRD-92-03X, respectively, but not in GRD-92-04X, thus suggesting a different source for this compound. The pesticides 2,2-bis(para-chlorophenyl)-1,1-dichloroethane (DDD), 2,2-bis(para-chlorophenyl)-1,1-dichloroethene (DDE), and 2,2-bis(para-chlorophenyl)-1,1,1-trichloroethane (DDT) were reported in sediment samples at concentrations of up to 0.15 μg/g. The highest concentrations were detected in the sample collected at GRD-92-04X. PCBs were not detected in the sediment samples.

A total of 19 PAL inorganics were detected in Grove Pond sediments (Table 2). Review of the data indicates that the highest concentrations of 16 of the 19 were found in either GRW-92-02X or GRW-92-03X at the northwest corner of Grove Pond. These included arsenic (910 μg/g), chromium (26,100 μg/g), copper (98.6 μg/g), and mercury (420 μg/g) in GRD-92-03X and aluminum (10,900 μg/g), barium (181 μg/g), iron (25,400 μg/g), nickel (36.9 μg/g), lead (390 μg/g), and zinc (447 μg/g) in GRD-92-02X. Arsenic, chromium, copper, lead, manganese, nickel, and zinc exceeded USEPA Region V sediment criteria in either one or both of GRD-92-02X and GRD-92-03X. Sample GRD-92-02X exceeded the Ontario Ministry of the Environment criterion for cadmium (Persaud, 1992). Samples GRD-92-01X, GRD-92-02X, and GRD-92-03X exceeded the Ontario Ministry of the Environment criterion for mercury. USEPA Region V sediment criteria and Ontario Ministry of the Environment guidelines are shown in Table 3. Grove Pond sediments, particularly those in the northwest cove, appeared heavily contaminated with these inorganics. The presence of arsenic, chromium, lead, and mercury and potentially other inorganics may be associated with waste disposal practices at the former tannery located near the northwest corner of Grove Pond.

In a related investigation ABB-ES collected samples of fish tissue from Plow Shop Pond for analysis for PAL inorganics, pesticides, and PCBs (ABB-ES, 1993b). Average concentrations of aluminum, iron, manganese, and zinc were higher than average concentrations for fish representing all trophic levels in the Massachusetts Department of Environmental Protection (MADEP), Division of Water Pollution Control database. Average and maximum concentrations of mercury in largemouth bass and bullhead exceeded regional and national reported concentrations. Maximum concentrations in bluegill exceeded national 85th

percentile concentrations. Cadmium was detected in one bass at a concentration slightly above the national 85th percentile. The pesticide DDE was detected in all analyzed species of fish and the PCB Aroclor-1260 was detected in one bass.

The U.S. Fish and Wildlife Service (USFWS) collected fish tissue samples from Grove Pond in 1992 and analyzed the samples for eight inorganics (arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc), PCBs, and the pesticides DDD, DDE, and DDT (USFWS, 1993). The reported results indicate that fillets from one of the ten sampled largemouth bass contained mercury at concentrations exceeding U.S. Food and Drug Administration (USFDA) standards (1.04 verses 1.0 parts per million [ppm]). Average mercury concentrations in fillets were less than 0.5 ppm. These results are in marked contrast to data obtained by ABB-ES in Plow Shop Pond bass fillets which had reported mercury concentrations of up to 4.0 milligrams per kilogram (mg/kg) (ABB-ES, 1993b). PCBs (up to 0.47 ppm), DDD (up to 0.10 ppm), and DDE (up to 0.27 ppm) were also reported in tissue samples collected by the USFWS, consistent with the findings of ABB-ES in Plow Shop Pond.

The MADEP collected six sediment samples along the western shore of Grove Pond in October 1992 and analyzed them for VOCs (USEPA Method 8240), SVOCs, pesticides/PCBs, metals, and TOC (Figure 4) (MADEP, 1993). Organic compounds were not reported above detection limits. Similar to the pattern of the ABB-ES data, the highest concentrations of arsenic, chromium, lead, and mercury were reported in samples from the northwest cove of the pond.

In December 1993 the Boston & Maine Corporation contracted the collection of surface water and sediment samples from Grove Pond as part of a Site Assessment to evaluate environmental site conditions along that portion of the B&MRR right-of-way (ERM, 1993). Four surface water and four sediment samples were collected (see Figure 4). Samples were analyzed for Target Compound List (TCL) VOCs (USEPA Method 8240), polynuclear aromatic hydrocarbons (PAHs)(USEPA Method 8270), TCL pesticides/PCBs (USEPA Method 8080), and Target Analyte List (TAL) metals.

Organic compounds were not reported in surface water samples (ERM, 1994). Nine inorganics (aluminum, barium, calcium, iron, magnesium, manganese, potassium, sodium, and zinc were reported. Aluminum was reported in only one

sample, and exceeded slightly the AWQC for fresh water aquatic life (110 versus 87 μg/L). Concentrations of barium, iron, and zinc were below AWQC.

Eleven PAHS were reported in sediment sample SW-1 at concentrations up to 7,100 μg/g and six were reported in sediment sample SW-2 at concentrations up to 1,300 μg/g. A surface soil sample collected from the shore adjacent to sediment sample SW-2 contained five of the six PAHs found at SW-2, but at higher concentrations as well as four other PAHs. Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene exceeded MADEP S-1 reportable concentrations in sediment sample SW-1 and to a lesser extent in sediment and soil samples from location SW-2. With the following exceptions, concentrations of TAL inorganics were below MADEP S-1/S-2 reportable concentrations: chromium (1,600 μg/g) at sediment location SW-1; cadmium (730 μg/g), cobalt (43 μg/g), copper (13,000 μg/g), and lead (620 μg/g) at sediment location SW-2; and arsenic (86 μg/g) at sediment location SW-4. TAL VOCs and pesticides/PCBs were not reported in the sediment samples. It should be noted that MADEP S-1/S-2 reportable concentrations consider risks only to human health receptors and not to ecological receptors.

1.4 Data Needs

Previous studies of Grove Pond have identified contaminants along the western shore and in the northwest cove of the pond. The existing data are not sufficient, however, to assess the potential presence of contaminants in other parts of the pond or vertically within the sediments, assess potential sources other than the former tannery, or to evaluate potential human health and ecological impacts.

The following sampling and evaluation activities are proposed to help answer these questions and, ultimately, to determine whether and to what extent sediment remediation may be appropriate:

- Measuring concentrations of PAL inorganics, SVOCs, pesticides/ PCBs, TOC, grain-size, and percent solids in Grove Pond whole sediment samples

- Measuring concentrations of PAL inorganics, SVOCs, pesticides/PCBs, TOC, and grain size in surface soil samples collected from selected locations along the shoreline of Grove Pond

- Measuring concentrations of PAL inorganics, SVOCs, and pesticides/PCBs as well as water quality parameters of pH, conductivity, dissolved oxygen, temperature, alkalinity, total hardness, TOC, TSS, and TDS, at selected locations in Grove Pond

- Conducting a qualitative ecological evaluation to characterize upland, wetland, and aquatic ecosystems at Grove Pond

Objectives and sampling design for each of these studies are discussed in Section 3.0.

2.0 GENERAL FIELD INVESTIGATION TASKS

This section describes the general tasks necessary to undertake and complete the site-specific tasks set forth in Section 3.0. The tasks proceed from planning, through field and laboratory work, and data evaluation.

2.1 PROJECT PLANS

Project planning begins prior to beginning field investigation work, and continues throughout the project in response to changing conditions and preliminary data interpretation.

Detailed discussions of relevant requirements, methods, and procedures are presented in this Work Plan and separately in the ABB-ES Fort Devens Project Operations Plan (POP), which includes elements of the Field Sampling Plan (FSP), the Quality Assurance Project Plan (QAPjP), and the Health and Safety Plan (HASP) (ABB-ES, 1993a). The POP contains the major elements of an FSP, in that program-specific procedures for investigation activities are described in detail as these activities are common to investigations that will be conducted at the installation. The POP is a working document that is revised as ABB-ES procedures change and emerging health and safety issues are addressed.

With the exception of detailed site-specific activities, the POP includes the QAPjP and elements of the FSP. The POP presents detailed descriptions and discussions of the following elements:

- Project Organization and Responsibilities
- Quality Assurance (QA) Objectives for Measurement
- General Sampling Procedures
- Sample Handling and Custody Procedures
- Equipment Calibration and Preventive Maintenance
- Analytical Procedures
- Data Management
- Internal Quality Control (QC)
- QA Activities
- Problem Prevention

- Data Assessment Procedures
- Corrective Actions
- Reports
- Site-Specific HASP

2.2 DATA QUALITY OBJECTIVES

Establishing data quality objectives (DQOs) is necessary to establish the level of detail required for proposed field investigation activities. Data generated during the field and laboratory tasks will be used to characterize sediment, assess sources, and to evaluate potential human health and ecological risks. The levels of data quality, USAEC Certification Classes, and DQOs for the project are specified in Volume I, Subsection 3.2 of the POP.

On-site field measurement of pH, conductivity, dissolved oxygen, and temperature will conform to the guidelines presented in Volume 1, Subsection 4.6 of the POP. Field measurement data will be considered representative of U.S. Environmental Protection Agency (USEPA) Level II data quality.

Data from off-site laboratory analysis of TOC, and other parameters for which USAEC performance demonstration is not required will be considered representative of USEPA Level III data quality.

Data from off-site laboratory analysis of inorganics in sediment will be considered representative of USEPA Level IV data quality.

2.3 FIELD INVESTIGATIONS

Fieldwork will be conducted in accordance with the procedures specifically identified in Volume I, Section 4.0 of the POP, or this Work Plan. A key controlling document for the methods and procedures used in conducting the field investigations will be *Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports* (USATHAMA, 1987). This document has been reviewed and its standard techniques have been included in the POP. Site-specific conditions, plans, and rationale are presented in Section 3.0 of this Work Plan.

The tasks necessary to undertake and complete the field investigation program are described in the following subsections.

2.3.1 Mobilization

Following authorization to begin fieldwork, ABB-ES and its subcontractors will mobilize to Fort Devens and implement the proposed field investigation program.

Mobilization will consist of field personnel orientation and equipment mobilization, and will take place before initiation of the field program. Field operations will be directed from the existing ABB-ES field office located in Building T-201 on Carey Street at Fort Devens. A field team orientation meeting will be held with ABB-ES personnel and subcontractors to familiarize on-site personnel with the site history, health and safety requirements, Fort Devens security requirements, and USAEC field procedures. Equipment mobilization will include, but will not be limited to, the transportation and setup of the following equipment:

- subcontractor equipment and necessary materials and supplies
- health and safety and decontamination equipment
- soil and sediment sampling equipment
- surface water sampling equipment

2.3.2 Site-Specific Field Investigation Tasks

The plans and rationale for site-specific field investigations, including analytical requirements, are described in detail in Section 3.0 of this Work Plan. Performing those investigations will involve combinations of the following tasks:

- field measurement of surface water pH, conductivity, dissolved oxygen, and temperature
- sediment sampling
- surface water sampling

- surface soil sampling
- ecological evaluation
- surveying

These tasks will be performed in accordance with the procedures presented in Volume I, Section 4.0 of the POP, or this Work Plan.

2.4 Laboratory Analytical Program

The laboratory analytical program for soils and sediments is designed to measure the concentration of PAL inorganics, SVOCs, pesticides/PCBs, TOC, percent solids, and grain size distribution. The proposed laboratory analytical program for surface water includes PAL inorganics, SVOCs, and pesticides/PCBs, TOC, alkalinity, total hardness, TSS, and TDS.

Off-site laboratory analytical procedures are presented in Volume 1, Section 7.0 of the POP (ABB-ES, 1993a). The laboratory QA Plan and USAEC Performance Demonstrated Analytical Methods are presented in Volume II of the POP, Appendices B and C, respectively.

2.5 Quality Assurance/Quality Control

Environmental sampling and analysis will be conducted in accordance with requirements of the USAEC QA Program (USATHAMA, 1990) and the POP. QC procedures established for ABB-ES' field activities include the use of calibration standards and blanks for pH, specific conductance, temperature, and photoionization meter measurements.

Details of the collection procedures and frequency of the QC samples are provided in Volume I, Section 9.0 of the POP. QA/QC samples typically submitted to the laboratory include duplicate samples, trip blanks, and equipment rinsate blanks. Duplicate samples are collected from 5 percent of all samples collected and analyzed for the same parameters as the sample that was duplicated. Trip blanks are collected (one per shipment) and shipped with all

coolers containing water samples to be analyzed for VOCs. These provide a basis for assessing the potential for contamination of samples with VOCs during sample collection or shipment. Because VOCs are not target analytes at Grove Pond, preparation and analysis of trip blanks is not required. Rinsate blank samples are collected from sampling equipment to address the potential for cross-contamination. The rinsate blanks will be analyzed for PAL parameters, as appropriate. Five percent matrix spike and matrix spike duplicates are analyzed to characterize matrix effects. Methods requiring surrogates do not require matrix spikes. Method blank samples will also be analyzed to maintain internal QA/QC at the laboratory.

Samples will be handled and conveyed to the subcontractor laboratory in accordance with specified chain of custody (COC) procedures. Sample management procedures, including sample container preservation requirements, COC program protocol and records, analytical request forms, and sample tracking and shipping are described in Volume I, Section 5.0 of the POP. ABB-ES will receive QA packages for all samples from the subcontractor laboratory and will independently review them.

While analyses are being conducted, the subcontractor laboratory QA Coordinator will provide the ABB-ES QA Supervisor with the documentation specified in Volume I, Subsection 7.3 of the POP. The subcontractor laboratory will supply copies of all corrective actions to ABB-ES for approval. Although the subcontractor laboratory controls laboratory operations, the ABB-ES QA Supervisor retains ultimate responsibility for data quality.

2.6 Physical Parameters

Grain-size distribution will be established for all surface soil samples and approximately one-third of all sediment samples from Grove Pond. Grain-size distribution will be conducted using standard sieve analyses for soils coarser than 0.075 millimeters (mm). For soils finer than 0.075 mm, grain-size distribution will be established by hydrometer.

2.7 Data Management

Geotechnical, biological, and chemical data generated as part of these field investigations will be managed in accordance with applicable USAEC data management procedures (discussed in Volume I, Section 8.0 of the POP). Data for this project will include the results of chemical analyses of biological and sediment samples, as well as the results of the sediment toxicity test program.

2.8 Data Evaluation

ABB-ES will evaluate data generated from the field investigations to confirm whether they meet specified DQOs, and to assess whether data needs have been adequately filled. Interpretation of the data will be part of the basis for deciding whether and to what extent additional characterization of Grove Pond is needed. Completed field investigations and resulting data will be documented in a Site Investigation (SI) report for Grove Pond.

2.9 Investigation Derived Waste

As part of field activities, waste materials will be generated in association with soil boring; monitoring well installation, development, and purging; sample collection and handling; and decontamination. This material will be handled and disposed of in accordance with Volume I, Subsection 4.10 of the POP. All drill cutting, development and purge water, and decontamination water will be tested with a photo-ionization detector (PID) using headspace procedures. All investigation-derived materials (water and/or soils) with PID readings above background will be containerized in 55-gallon steel drums in accordance with the POP. If no contamination is detected, cuttings, fluids, and sediments will be returned to the local setting.

3.0 SITE SPECIFIC SUPPLEMENTAL SAMPLING ACTIVITIES

This section presents the site-specific objectives and sampling design for supplemental sampling activities at Grove Pond. A summary of the proposed sampling and analysis activities described in this work plan is presented in Table 4.

3.1 SEDIMENT SAMPLING

Proposed sediment sampling and analysis activities include collection of shallow (0 to 6 inches) sediment samples from 48 locations, and deeper (18 to 24 inches) samples from 10 of these 48 locations. Unless field conditions dictate otherwise, the shallow sediment sampling will be accomplished using a pole-mounted Ekman dredge. Sampling of deeper sediment will be conducted using a pole-mounted split-spoon hand corer and/or a gravity cover. Figure 5 shows these locations and Table 5 provides a brief description of the location and purpose of each. These locations were selected to provide a pond-wide characterization of shallow sediments with emphasis on the northwest cove. Sediment sampling stations will be field located with an electronic distance meter (EDM) or a Global Positioning System (GPS). Pond water depths will be recorded at each sediment sampling station. Shallow sediment samples will be collected in accordance with Volume I, Subsection 4.5.3, of the POP (ABB-ES, 1993a).

Sediment samples will be analyzed for PAL inorganics, SVOCs, and pesticides/ PCBs. VOCs would not be expected to persist in Grove Pond sediment and previous data indicate that they are not present, therefore analysis for this class of contaminants is not proposed. The sediment samples will also be analyzed for TOC, grain size distribution, and percent solids as indicated in Table 4. A sub-set consisting of 4 of the 45 proposed sediment samples will be analyzed for methylmercury to obtain preliminary information on its presence.

3.2 SURFACE WATER SAMPLING

Six locations are proposed for surface water sampling in Grove Pond. These locations are collocated with 6 proposed sediment sampling stations and were

selected to represent surface water at the following locations: the inlet to Grove Pond (GRW-94-06X); the central portion of Grove Pond (GRW-94-07X); close to shore adjacent to the location of the former tannery (GRW-94-08X); within the northwest cove (GRW-94-09X); the mid-point of the channel connecting the southwest cove to the main part of the pond (GRW-94-10X); and at the pond outlet (GRW-94-11X). At each surface water station, water depth and the following water quality field measurements will be collected: pH, dissolved oxygen, conductivity, and temperature. VOCs would not be expected to persist in Grove Pond surface water and have not been identified at concentrations of concern in previous surface water or sediment samples, therefore they are not included as surface water analytes. Although SVOCs and pesticides/PCBs would be expected to partition to the sediments, they may be transported by surface water and are included as surface water analytes because they were previously detected in sediments.

The following table lists the surface water sample points and the corresponding sediment sampling location.

DESCRIPTION	SURFACE WATER SAMPLE POINT	SEDIMENT SAMPLE POINT
At pond inlet	GRW-94-06X	GRD-94-09X
Midpoint of pond	GRW-94-07X	GRD-94-51X
Adjacent to tannery	GRW-94-08X	GRD-94-27X
Northwest cove	GRW-94-09X	GRD-94-32X
Channel to SW cove	GRW-94-10X	GRD-94-42X
At pond outlet	GRW-94-11X	Not collocated. Sample to be at mid-channel, approximately 100 ft. upstream of culvert

3.3 Surface Soil Sampling

The collection of surface soil samples from 15 shoreline locations is proposed to assess the potential for shoreline soils and/or contaminated runoff to have been or to be a source of sediment contamination. These sample locations will be located adjacent to sediment sample locations in areas where current or historical land use suggests the potential for contaminated runoff or other contaminant transport/release mechanisms. Figure 5 shows the proposed location of the surface soil samples. Samples will be collected from a depth of 0 to 6 inches and will be analyzed for PAL inorganics, SVOCs, pesticides/PCBs, TOC, and grain size distribution.

3.4 Ecological Evaluation

A limited ecological characterization will be conducted to identify ecological receptors potentially exposed to contamination identified at Grove Pond. To identify potential receptors and exposure pathways, ecological communities at and in the vicinity of Grove Pond will be identified through literature review, consultation with known experts in the field, and review of relevant information sources including maps and historical records. Information gathered previously regarding ecological receptors at and in the vicinity of Grove Pond will be supplemented with additional data from the information source review, and from consultation with local, state, and federal aquatic, wetlands, and terrestrial authorities.

Following the information review, a limited field reconnaissance program will be initiated to characterize aquatic and wetland habitats at Grove Pond. This field program will involve a site inspection by a two person team of wetland-aquatic specialists. The limited ecological field program will qualitatively characterize the ecological communities associated with Grove Pond. Possible site-specific exposure pathways through which ecological receptors could be exposed to contaminated media will be evaluated. Evidence of ecological stress in plant species (e.g., yellowing, wilting, insect infestations) and animal species (e.g., disease, parasitism, death) will be noted. Any state or federally-listed rare and endangered biota identified at the site will be recorded.

The field reconnaissance program will identify and verify major wetlands vegetative cover types and dominant taxa associated with Grove Pond. Habitat types will be field mapped onto existing base maps (not-surveyed-to-scale). Lists of flora and fauna encountered or expected at the site will be generated. Observations of plants, fish, invertebrates, amphibians, reptiles, birds, and mammals will be noted for each habitat present.

In addition, the SI report will include a comparison of the analytical data to available ecological standards and criteria for surface water and sediment. Based on the ecological evaluation, an assessment will be made as to whether Grove Pond contamination poses a current or potential threat to ecological receptors.

4.0 PROJECT MANAGEMENT

The project organization structure is illustrated in Figure 6. Solid lines on the figure depict direct lines of control while dotted lines indicate channels of communication. Rationale for project organization and resource allocation are discussed in the POP. QA/QC procedures and responsibilities for ABB-ES, USAEC, and laboratory personnel are also described in the POP.

4.1 PROJECT MANAGEMENT

The duties, functions, and responsibilities associated with project management are detailed in the following paragraphs.

Program Manager. The Program Manager for ABB-ES' USAEC efforts is Mr. Joseph T. Cuccaro. He is responsible for providing direction, coordination, and continuous monitoring and review of the program. His responsibilities include initiating program activities; participating in work plan preparation; coordinating staff assignments; assisting in the identification and fulfillment of equipment and special resource needs; monitoring all task activities to confirm compliance with schedule, fiscal, and technical objectives; maintaining communications both internally and with the USAEC Contracting Officer's Representative (COR) through continuous interaction, thereby allowing quick resolution of potential problems; providing final review and approval of work plans, task deliverables, schedules, contract changes, and manpower allocations; and developing coordination among management, field teams, and support personnel to maintain consistency of performance.

Project Manager. The Project Manager for ABB-ES' Fort Devens efforts, Mr. Paul Exner, P.E., has the day-to-day responsibility for conducting the Fort Devens project. The Project Manager is responsible for confirming the appropriateness and adequacy of the technical or engineering services provided for a specific task; developing the technical approach and level of effort required to address each element of a task; supervising day-to-day conduct of the work, including integrating the efforts of all supporting disciplines and subcontractors for all tasks; overseeing the preparation of all reports and plans; providing for QC and quality review during performance of the work; confirming technical integrity, clarity, and

usefulness of task work products; forming a task group with expertise in disciplines appropriate to accomplish the work; reviewing and approving sampling tests and QA plans, which include monitoring site locations, analysis methods to be used, and hydrologic and geophysical techniques to be used; developing and monitoring task schedules; supervising task fiscal requirements (e.g., funds management for labor and materials), and reviewing and approving all invoicing actions; and providing day-to-day communication, both within the ABB-ES team and with the USAEC COR, on all task matters including task status reporting.

Corporate Officer. ABB-ES' Corporate Officer, William R. Fisher, P.E., is responsible for ensuring that a contract for the services to be provided has been executed; necessary corporate resources are committed to conduct the program activities; corporate level input and response is readily available to both the ABB-ES team and the USAEC COR; and assistance is provided to the Program and Project Managers for project implementation.

Technical Director and Project Review Committee. The members of the Project Review Committee for this Task Order are Mr. James Buss, P.G.; Mr. Michael Murphy; and Mr. Jeff Brandow. Mr. Buss will serve as Technical Director and will be responsible for the overall technical quality of the work performed; he also will serve as chairman of the review committee. The function of this group of senior technical and/or management personnel is to provide guidance and oversight on the technical aspects of the project. This is accomplished through periodic reviews of the services provided to confirm that they represent the accumulated experience of the firm, are being produced in accordance with corporate policy, and live up to the objectives of the program as established by ABB-ES and USAEC.

Quality Assurance Supervisor. Mr. Christian Ricardi is the QA Supervisor for ABB-ES' USAEC program and this project. The QA function has been established so that appropriate protocols from USAEC, Commonwealth of Massachusetts, and USEPA Region 1 are followed. In addition, the QA Supervisor must confirm that QC plans are in place and implemented for each element of the task. The QA Supervisor reports directly to the Program Manager, but is responsible to the Project Manager in matters related to management of the QA/QC work element. The QA Supervisor is independent of the Project Manager relative to corrective action. The QA Supervisor has authority to stop work that is not in compliance with the POP, provided he has

the concurrence of the USAEC Geology and Chemistry Branch, the Program Manager, the COR, and the Contracting Officer.

Health and Safety Supervisor. Ms. Cynthia E. Sundquist is the Health and Safety Supervisor for the Fort Devens project, reporting directly to the Project Manager. She has stop work authority to prevent or mitigate any unacceptable health and safety risks to project personnel, the general public, or the environment. Responsibilities of this position include confirming that the project team and, in particular, field personnel, comply with the ABB-ES HASP; helping the Program Manager and Project Manager develop the site-specific HASP; making certain that the HASP is distributed to appropriate personnel; and informing the Program Manager and the appropriate USAEC personnel in the specified manner when any health- or safety-related incident occurs.

Contract Manager. Ms. Elaine H. Findlay is the Contract Manager for the Fort Devens effort. The Contract Manager supports the Program Manager and Project Manager in all contractual matters, providing a liaison between contract representatives for USAEC and all subcontracted services.

Project Administrator. Ms. Tina Clark is the Project Administrator for the Fort Devens effort. The Project Administrator supports the Program Manager and Project Manager in the day-to-day monitoring of fiscal, schedule, and documentation requirements. She is responsible for maintaining the necessary systems to support budget monitoring and controls, and schedule monitoring and maintenance; and for controlling the flow and processing of documentation.

Task Leader. Mr. Stanley Reed will serve as Task Leader for the Grove Pond Field Investigation. As a Task Leader, he is responsible for planning all ABB-ES' geologic, hydrogeologic, and ecological investigations. He also is responsible for the interpretation of all chemical and hydrogeologic information and data for the preparation of the Grove Pond SI Report.

Field Operations Leader. Mr. Douglas Pierce will serve as the Field Operations Leader for the Fort Devens Field Program. As Field Operations Leader he is responsible for conducting the field program in accordance with procedures outlined in the Work Plan and POP.

Laboratory/Data Management Leader. Mr. Tim Dame, as the coordinator of laboratory services, is responsible for implementing and maintaining the Fort Devens analytical program. His responsibilities as the Laboratory Management Leader will include coordination with the Project Manager, QA Supervisor, and the analytical subcontractor on overall project and individual site analytical efforts. As the Data Management Leader, Mr. Dame is responsible for operating and maintaining the database management systems committed to USAEC projects.

4.2 SUBCONTRACTORS

The following services and/or activities will be performed by subcontractors during the Grove Pond field investigation activities: laboratory chemical analysis, and surveying.

Laboratory Chemical Analysis. The primary analytical laboratory for samples collected by ABB-ES at Fort Devens is Environmental Science & Engineering, Inc. (ESE) of Gainesville, Florida. ESE's analytical program is USAEC-approved. If ESE cannot provide the specialized analytical services required for implementation of this Work Plan, supplemental services will be subcontracted.

Surveying Services. A professional land surveying company registered in the Commonwealth of Massachusetts, may be subcontracted to establish map coordinates and elevations for sediment sampling locations. Surveying activities will be coordinated and monitored by the Field Operations Leader, who will keep the Project Manager informed on a day-to-day basis.

5.0 SCHEDULE

The projected schedule for the Grove Pond SI is shown in Figure 7. This figure shows the anticipated timeline for conducting field activities and laboratory analysis and for preparing the draft SI report. Field tasks are scheduled to be completed in five-day work shifts beginning in April 1995.

ABB-ES	ABB Environmental Services, Inc.
AWQC	Ambient Water Quality Criteria
B&MRR	Boston and Maine Railroad
COC	chain of custody
COR	Contracting Officer's Representative
DDD	2,2-bis(para-chlorophenyl)-1,1-dichloroethane
DDE	2,2-bis(para-chlorophenyl)-1,1-dichloroethene
DDT	2,2-bis(para-chlorophenyl)-1,1,1-trichloroethane
DQO	Data Quality Objective
ESE	Environmental Science and Engineering
EDM	Electronic Distance Meter
FS	Feasibility Study
FSP	Field Sampling Plan
GPS	global positioning system
HASP	Health and Safety Plan
MADEP	Massachusetts Department of Environmental Protection
mg	milligram
mg/kg	milligrams per kilogram
mm	millimeter
PAH	Polynuclear Aromatic Hydrocarbon
PAL	Project Analyte List
PCB	polychlorinated biphenyl
PID	photoionization detector
ppm	parts per million
POP	Project Operations Plan
PRE	Preliminary Risk Evaluation

QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QC	Quality Control
SI	site investigation
SVOC	semi-volatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
μg/g	micrograms per gram
μg/L	micrograms per liter
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
USFDA	U.S. Food and Drug Administration
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

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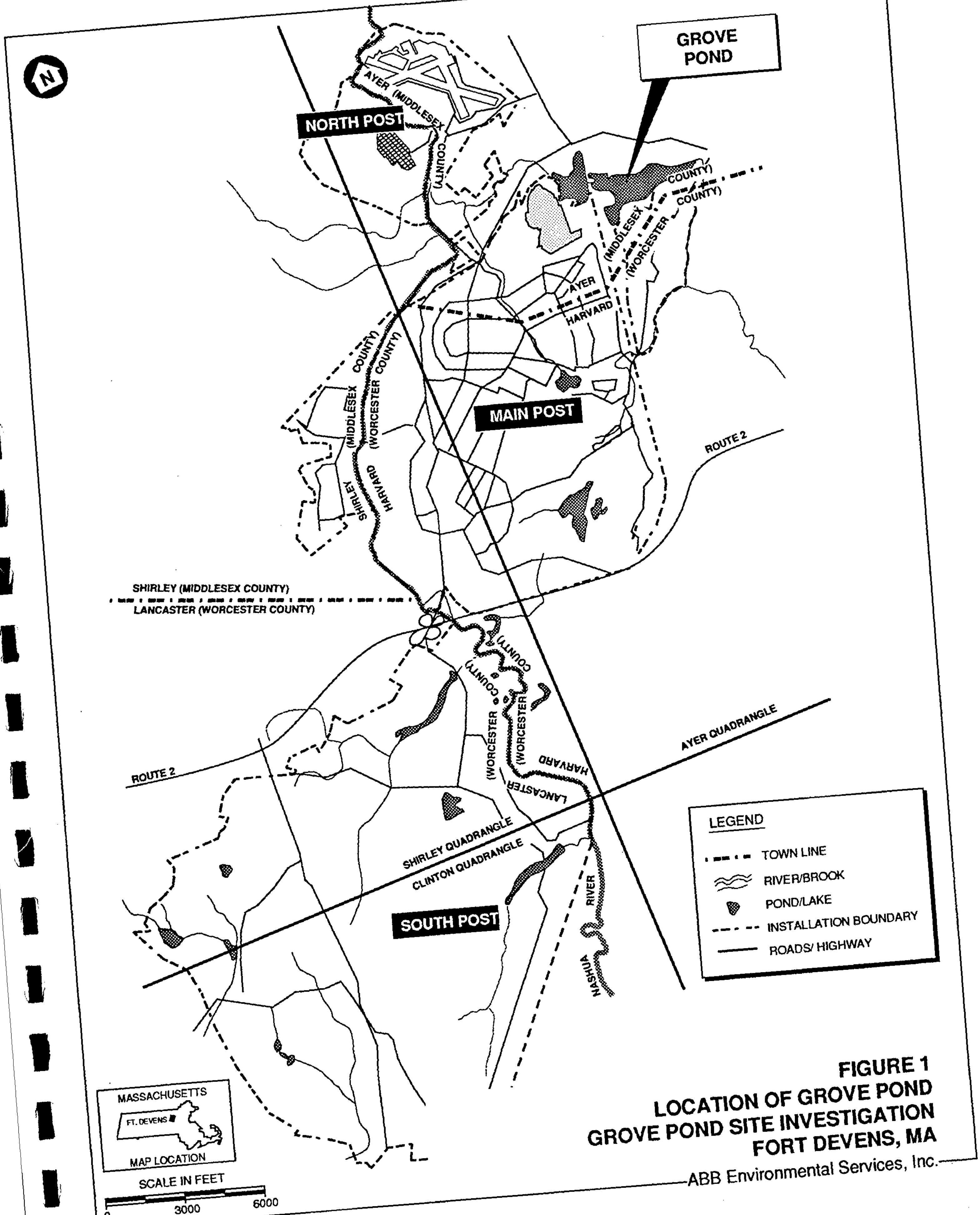

FIGURE 1
LOCATION OF GROVE POND
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

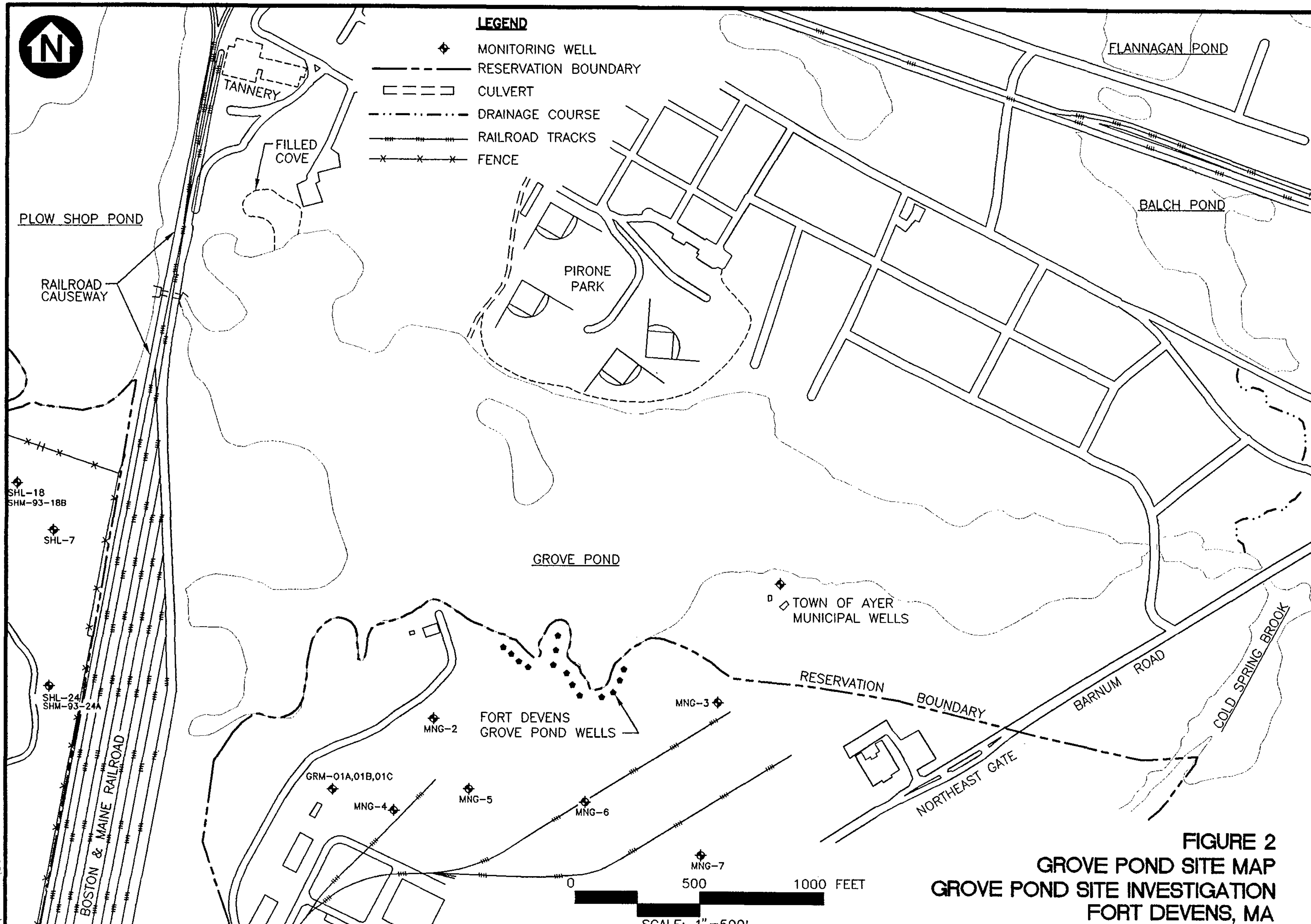

FIGURE 2
GROVE POND SITE MAP
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

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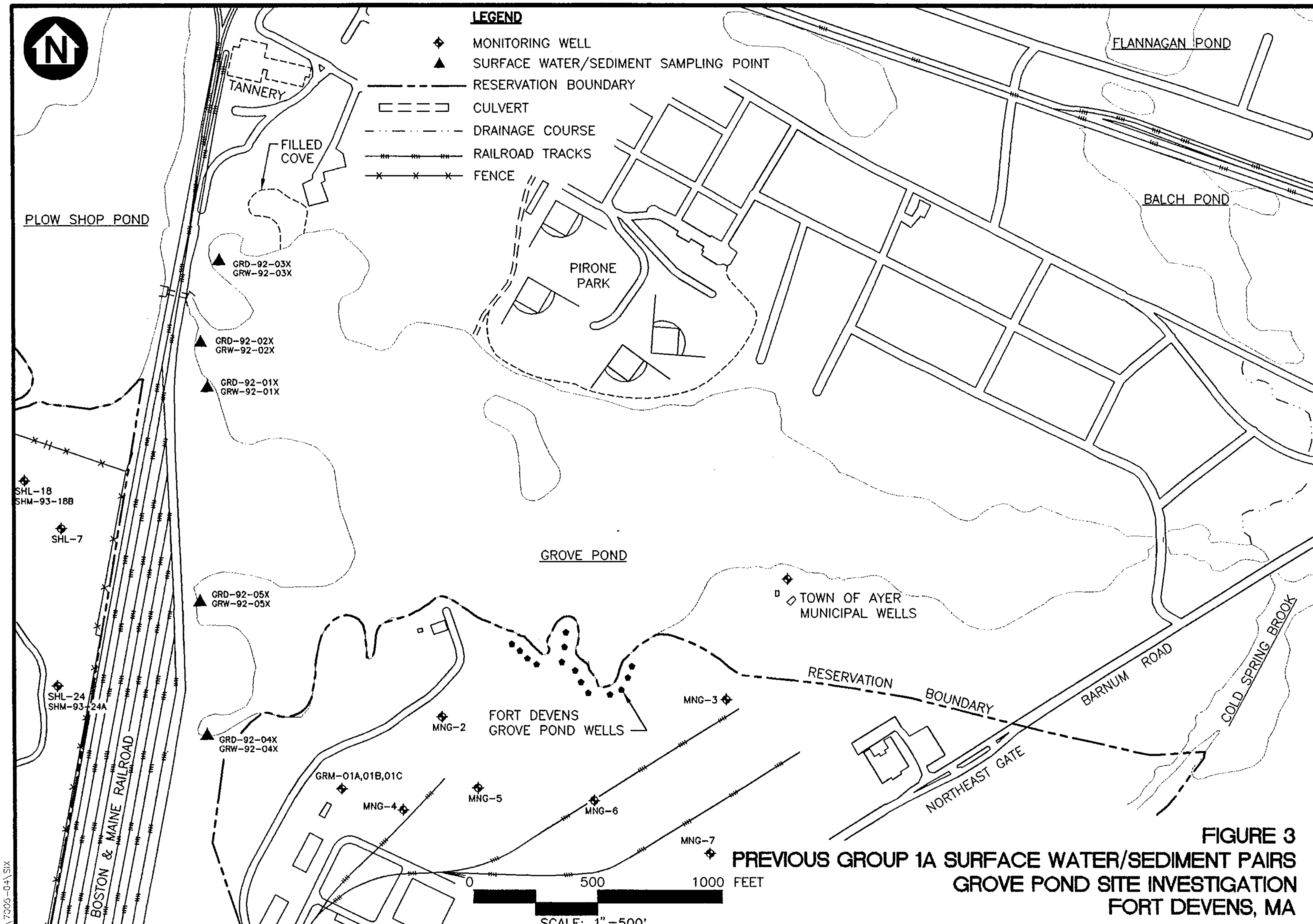

FIGURE 3
PREVIOUS GROUP 1A SURFACE WATER/SEDIMENT PAIRS
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

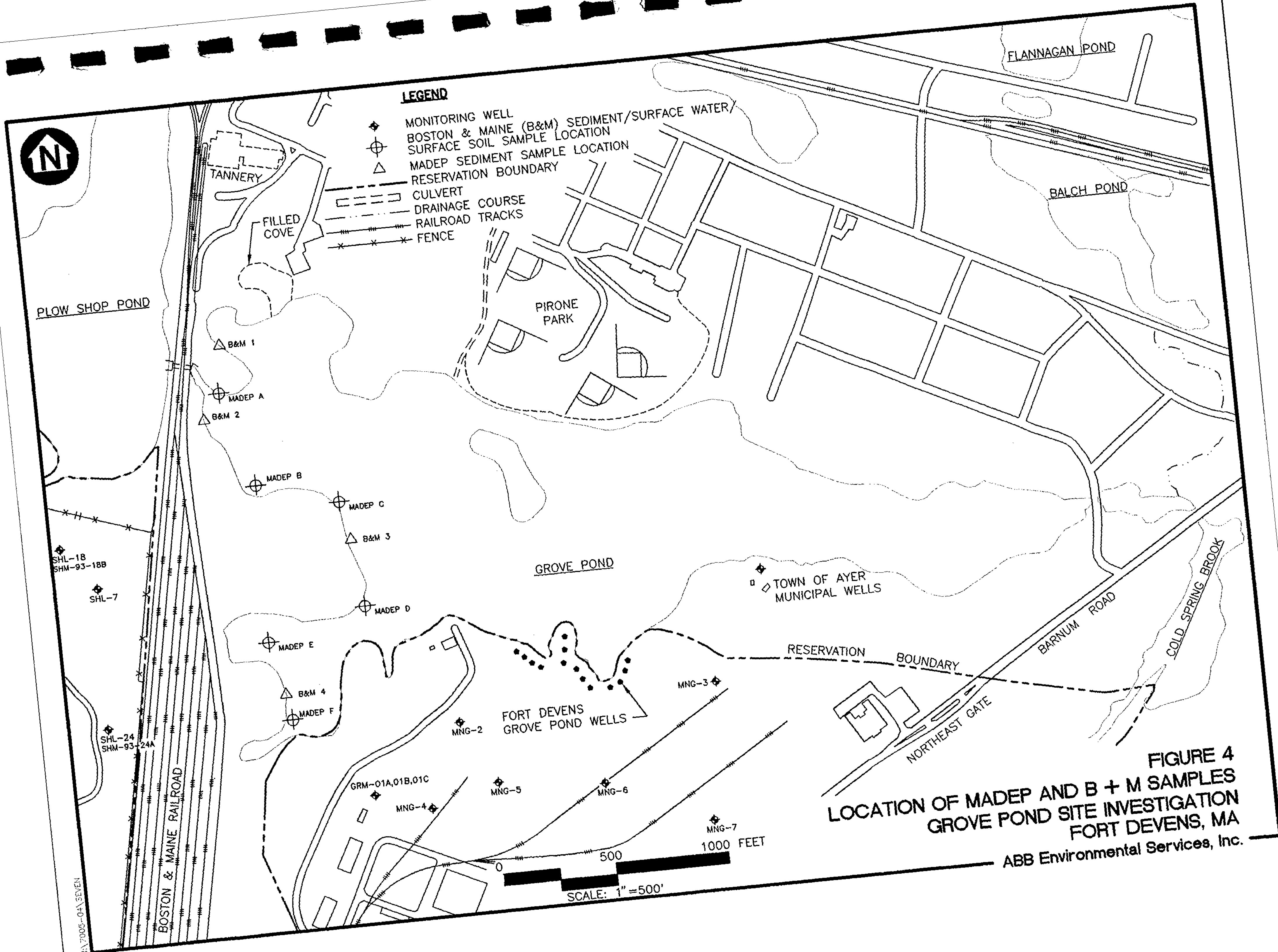

FIGURE 4
LOCATION OF MADEP AND B + M SAMPLES
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

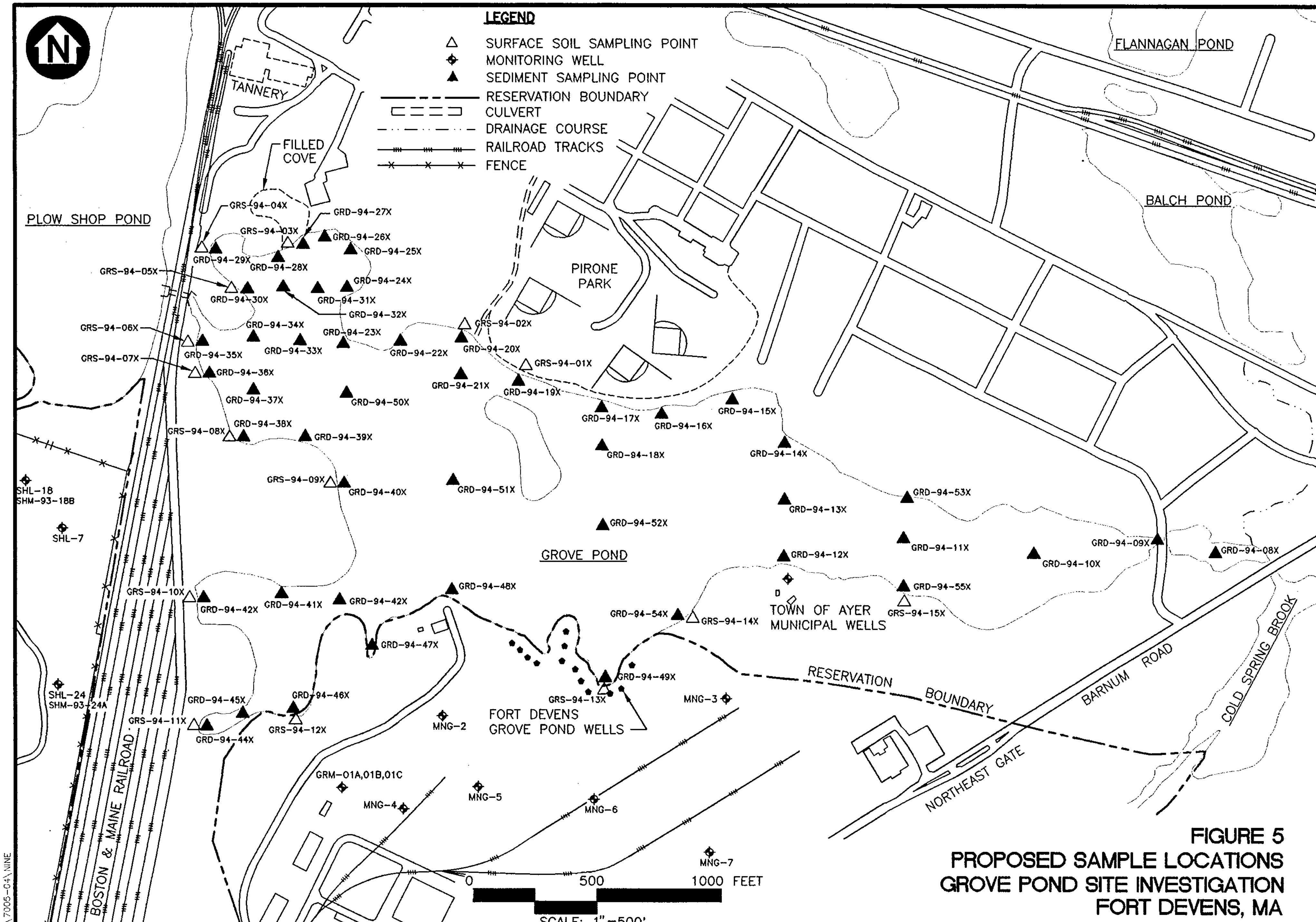

FIGURE 5
PROPOSED SAMPLE LOCATIONS
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

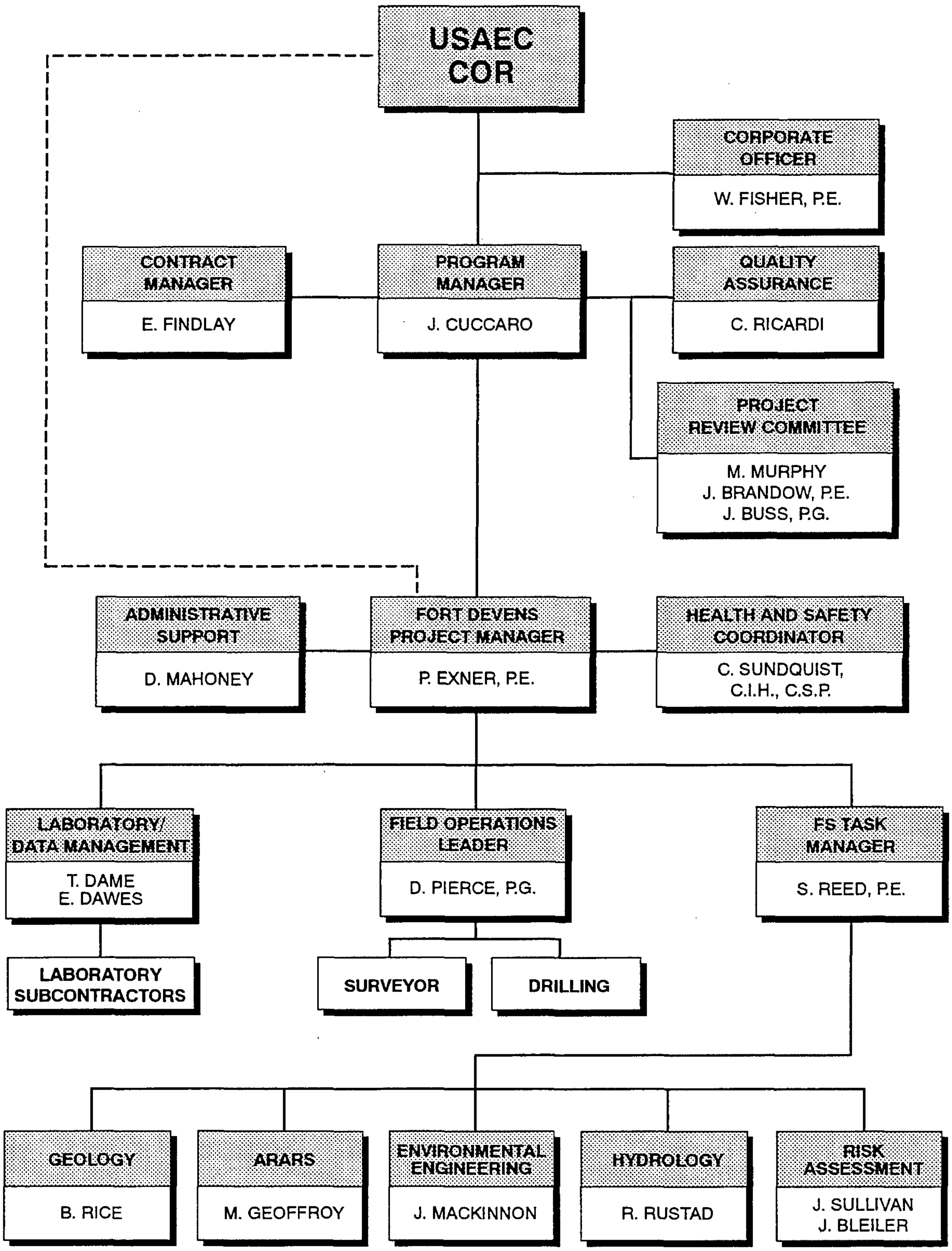

FIGURE 6
PROJECT ORGANIZATION
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

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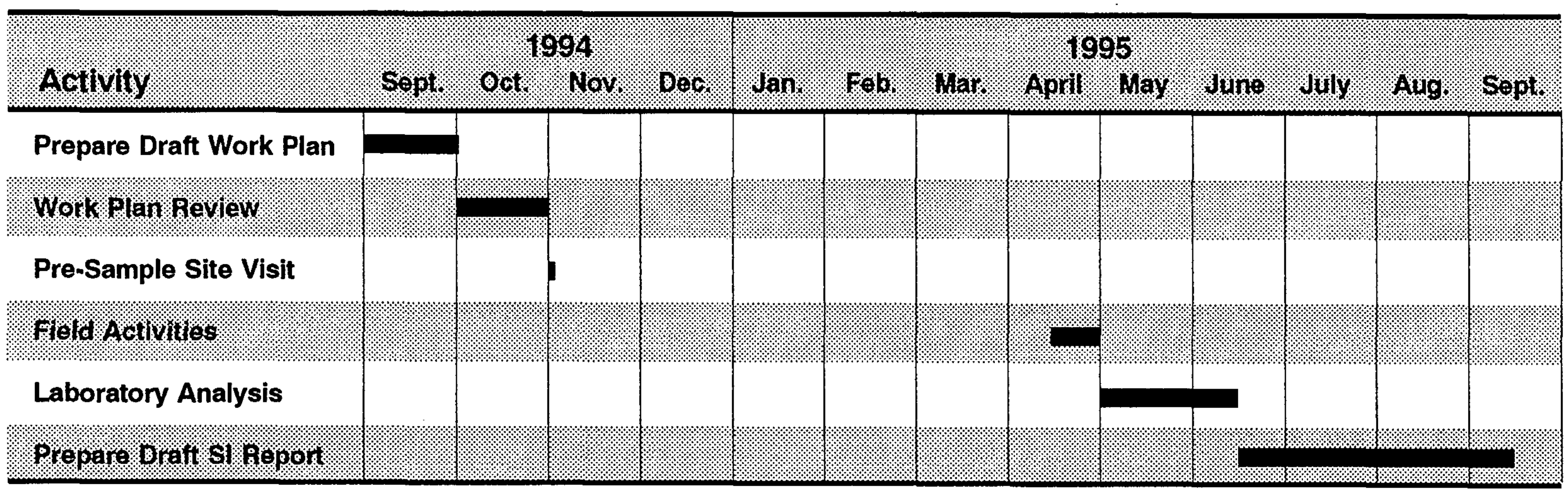

FIGURE 7
SI ACTIVITY SCHEDULE
GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ABB Environmental Services, Inc.

W9502012D(b)

TABLE 1
PREVIOUS GROUP 1A SURFACE WATER SAMPLE ANALYTICAL RESULTS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	GRW-92-01X	GRW-92-02X	GRW-92-03X	GRW-92-04X	GRW-92-05X
ORGANICS (ug/L)					
trichloroethylene / trichloroethene	< 0.5	< 0.5	< 0.5	0.5	< 0.5
INORGANICS (ug/L)					
aluminum	< 141	< 141	< 141	2960	< 141
arsenic	< 2.54	< 2.54	< 2.54	4.05	< 2.54
barium	34.1	20.6	18.1	42.3	33.8
calcium	9450	9310	11200	19700	15500
iron	156	485	671	841	451
potassium	2070	1370	1360	2570	2600
magnesium	1930	1770	1640	2730	1850
manganese	16.7	71.7	748	178	72.5
sodium	22000	19400	21100	18100	15500
lead	2.06	< 1.26	< 1.26	6.18	4.23
OTHER (ug/L)					
alkalinity	153000	NA	NA	8000	37000
total hardness	30400	NA	NA	54800	47600
total dissolved solids	102000	NA	NA	132000	110000
total organic carbon	NA	4690	5790	NA	NA
total suspended solids	< 4000	7000	76000	80000	< 4000

Notes:

< = less than

NA = not analyzed

TABLE 2
PREVIOUS GROUP 1A SEDIMENT SAMPLE ANALYTICAL RESULTS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	GRD-92-01X	GRD-92-02X	GRD-92-03X	GRD-92-04X	GRD-92-05X
	0 FT	0 FT	0 FT	0 FT	0 FT
ORGANICS (ug/g)					
acetone	0.046	0.81	0.32	< 0.017	0.13
toluene	< 0.001	0.013	< 0.001	< 0.001	< 0.001
2-methylnaphthalene	< 0.2	< 0.049	< 0.049	0.7	< 0.5
4-methylphenol / 4-cresol	< 1	12	17	< 1	< 2
acenaphthylene	< 0.2	< 0.033	< 0.033	0.3	< 0.3
anthracene	< 0.2	< 0.033	< 0.033	0.4	< 0.3
chrysene	< 0.6	< 0.12	< 0.12	2	< 1
fluoranthene	< 0.3	< 0.068	< 0.068	3	< 0.7
fluorene	< 0.2	< 0.033	< 0.033	0.6	< 0.3
naphthalene	< 0.2	3.7	5.6	0.8	< 0.4
phenanthrene	< 0.2	0.5	0.44	3	< 0.3
pyrene	< 0.2	< 0.033	< 0.033	2	< 0.3
PESTICIDES/PCBs					
2,2-Bis (p-chlorophenyl)-1,1-dichloroethane	0.034	ND 0.270 R	ND 0.270 R	0.15	< 0.008
2,2-Bis (p-chlorophenyl)-1,1-dichloroethene	0.024	ND 0.310 R	ND 0.310 R	0.016	< 0.008
2,2-Bis (p-chlorophenyl)-1,1,1-trichloroethane	< 0.007	ND 0.310 R	ND 0.310 R	0.015	< 0.007
INORGANICS (ug/g)					
aluminum	4450	10900	8160	8540	6430
arsenic	23	350	910	11.6	3.09
barium	23.2	181	156	35.3	83.3
calcium	1440	18000	12000	1760	24800
cadmium	< 0.7	8.16	< 0.7	< 0.7	< 0.7
cobalt	3.63	18.1	< 1.42	3.1	< 1.42
chromium	692	19900	26100	23.8	< 4.05
copper	15.5	79.9	98.6	13	< 0.965
iron	6620	25400	20000	9210	1180
mercury	2	260 L	420 L	< 0.05	< 0.05
potassium	712	< 100	< 100	757	< 100
magnesium	1320	1730	1340	2440	890
manganese	68.6	783	313	55.3	1640
sodium	311	2400	3110	289	727
nickel	8.97	36.9	23.2	12.9	< 1.71
lead	50	390	38.8	27	4.26
selenium	< 0.25	3.99	4.44	< 0.25	3.19
vanadium	11.2	43.6	< 3.39	13	< 3.39
zinc	80.8	447	303	28.6	< 8.03
OTHER (ug/g)					
total organic carbon	81600	NA	NA	11100	505000
SOLIDS (% WET WT)	55.6	10	10.8	52.3	20.8

Notes:
< = Less than
L = Missed holding time for analysis.
NA = Not analyzed
R = Analyte required for reporting purposes, but not currently certified
ND = not detectable

TABLE 3
SEDIMENT QUALITY GUIDELINE VALUES

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

ANALYTE	ONTARIO LOWEST EFFECT LEVEL[1]	USEPA REGION V GUIDELINES[2]
INORGANICS (mg/kg)		
Aluminum	NA	NA
Arsenic	6	3
Barium	NA	20
Calcium	NA	NA
Cadmium	0.6	6
Chromium	26	25
Cobalt	50	NA
Copper	16	25
Iron	20,000	17,000
Lead	31	40
Magnesium	NA	NA
Manganese	460	300
Mercury	0.2	>1
Nickel	16	20
Potassium	NA	NA
Selenium	NA	NA
Sodium	NA	NA
Vanadium	NA	NA
Zinc	120	90

Notes:

1 Lowest Effect Level (LEL) values reported in "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario" (Persaud et al., 1992).

2 Values are from USEPA Region V Sediment Classification System (1977). Levels above those listed are moderately polluted, levels below are considered non-polluted.

NA = not available

TABLE 4
SAMPLING AND LABORATORY ANALYSIS SCHEDULE

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

FILE TYPE	SITE TYPE	MEDIA	SITE ID	SAMPLE ID	LABORATORY SAMPLE #	MS/ MSD	DUP	VOCs	SVOCs	PESTS/ PCBs	TOTAL METALS	METH. MERC.	TOC	WATER QUAL.	GRAIN DIST.	% SOLIDS
WATER SAMPLES																
CSW	POND	Surface Water	GRW-94-06X	WXGR0600	DV1AW*				1	1	1		1	1		
CSW	POND	Surface Water	GRW-94-07X	WXGR0700	DV1AW*				1	1	1		1	1		
CSW	POND	Surface Water	GRW-94-08X	WXGR0800	DV1AW*				1	1	1		1	1		
CSW	POND	Surface Water	GRW-94-09X	WXGR0900	DV1AW*				1	1	1		1	1		
CSW	POND	Surface Water	GRW-94-10X	WXGR0800	DV1AW*				1	1	1		1	1		
CSW	POND	Surface Water	GRW-94-11X	WXGR0900	DV1AW*				1	1	1		1	1		
WATER SAMPLE SUBTOTAL								0	6	6	6	0	6	6	0	0
Trip Blanks								0	0	0	0	0	0	0	0	0
Duplicates @ 5%								0	1	1	1	0	1	1	0	0
MS/MSD Samples @ 5%								0	0	1	1	0	0	0	0	0
Rinsate Blanks @ 5%								0	1	1	1	0	0	0	0	0
WATER SAMPLE TOTAL								0	8	9	9	0	7	7	0	0

TABLE 4
SAMPLING AND LABORATORY ANALYSIS SCHEDULE

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

FILE TYPE	SITE TYPE	MEDIA	SITE ID	SAMPLE ID	LABORATORY SAMPLE #	MS/ MSD	DUP	VOC	SVOCs	PESTS/ PCBs	TOTAL METALS	METH. MERC.	TOC	WATER QUAL.	GRAIN DIST.	% SOLIDS
SURFACE SOIL SAMPLES																
CSO	PLUG	Soil	GRS-94-01X	SXGR0100	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-02X	SXGR0200	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-03X	SXGR0300	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-04X	SXGR0400	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-05X	SXGR0500	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-06X	SXGR0600	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-07X	SXGR0700	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-08X	SXGR0800	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-09X	SXGR0900	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-10X	SXGR1000	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-11X	SXGR1100	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-12X	SXGR1200	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-13X	SXGR1300	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-14X	SXGR1400	DV1AS*				1	1	1		1		1	
CSO	PLUG	Soil	GRS-94-15X	SXGR1500	DV1AS*				1	1	1		1		1	
SURFACE SOIL SAMPLE SUBTOTAL								0	15	15	15	0	15	0	15	0
Trip Blanks								0	0	0	0	0	0	0	0	0
Duplicates @ 5%								0	1	1	1	0	1	0	0	0
MS/MSD Samples @ 5%								0	0	1	1	0	0	0	0	0
Rinsate Blanks @ 5%								0	1	1	1	0	0	0	0	0
SURFACE SOIL SAMPLE TOTAL								0	17	18	18	0	16	0	15	0

TABLE 4
SAMPLING AND LABORATORY ANALYSIS SCHEDULE

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

FILE TYPE	SITE TYPE	MEDIA	SITE ID	SAMPLE ID	LABORATORY SAMPLE #	MS/ MSD	DUP	VOC	SVOCs	PESTS/ PCBs	TOTAL METALS	METH. MERC.	TOC	WATER QUAL.	GRAIN DIST.	% SOLIDS
SEDIMENT SAMPLES																
CSE	POND	Sediment	GRD-94-08X	DXGR0800	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-09X	DXGR0900	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-10X	DXGR1000	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-11X	DXGR1100	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-12X	DXGR1200	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-13X	DXGR1300	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-14X	DXGR1400	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-15X	DXGR1500	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-16X	DXGR1600	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-17X	DXGR1700	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-18X	DXGR1800	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-19X	DXGR1900	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-20X	DXGR2000	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-21X	DXGR2100	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-22X	DXGR2200	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-23X	DXGR2300	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-24X	DXGR2400	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-25X	DXGR2500	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-26X	DXGR2600	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-26X	DXGR26--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-27X	DXGR2700	DV1AS*				1	1	1	1	1		1	1
CSE	POND	Sediment	GRD-94-27X	DXGR27--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-28X	DXGR2800	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-28X	DXGR28--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-29X	DXGR2900	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-29X	DXGR29--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-30X	DXGR3000	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-30X	DXGR30--	DV1AS*				1	1	1		1		1	1

TABLE 4
SAMPLING AND LABORATORY ANALYSIS SCHEDULE

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

FILE TYPE	SITE TYPE	MEDIA	SITE ID	SAMPLE ID	LABORATORY SAMPLE #	MS/ MSD	DUP	VOC	SVOCs	PESTS/ PCBs	TOTAL METALS	METH. MERC.	TOC	WATER QUAL.	GRAIN DIST.	% SOLIDS
SEDIMENT SAMPLES																
CSE	POND	Sediment	GRD-94-31X	DXGR3100	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-32X	DXGR3200	DV1AS*				1	1	1	1	1		1	1
CSE	POND	Sediment	GRD-94-32X	DXGR32--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-33X	DXGR3300	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-33X	DXGR33--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-34X	DXGR3400	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-35X	DXGR3500	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-36X	DXGR3600	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-36X	DXGR36--	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-37X	DXGR3700	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-38X	DXGR3800	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-39X	DXGR3900	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-40X	DXGR4000	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-41X	DXGR4100	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-42X	DXGR4200	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-43X	DXGR4300	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-44X	DXGR4400	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-45X	DXGR4500	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-46X	DXGR4600	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-47X	DXGR4700	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-48X	DXGR4800	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-49X	DXGR4900	DV1AS*				1	1	1		1			1
CSE	POND	Sediment	GRD-94-50X	DXGR5000	DV1AS*				1	1	1	1	1		1	1
CSE	POND	Sediment	GRD-94-50X	DXGR50--	DV1AS*				1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-51X	DXGR5100	DV1AS*				1	1	1		1			1

TABLE 4
SAMPLING AND LABORATORY ANALYSIS SCHEDULE

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

FILE TYPE	SITE TYPE	MEDIA	SITE ID	SAMPLE ID	LABORATORY SAMPLE	#	MS/ MSD	DUP	VOC	SVOCs	PESTS/ PCBs	TOTAL METALS	METH. MERC.	TOC	WATER QUAL.	GRAIN DIST.	% SOLIDS
CSE	POND	Sediment	GRD-94-52X	DXGR5200	DV1AS*					1	1	1	1	1		1	1
CSE	POND	Sediment	GRD-94-52X	DXGR52--	DV1AS*					1	1	1		1		1	1
CSE	POND	Sediment	GRD-94-53X	DXGR5300	DV1AS*					1	1	1		1			1
CSE	POND	Sediment	GRD-94-54X	DXGR5400	DV1AS*					1	1	1		1			1
CSE	POND	Sediment	GRD-94-55X	DXGR5500	DV1AS*					1	1	1		1			1
SEDIMENT SAMPLE SUBTOTAL									0	58	58	58	4	58	0	18	58
Trip Blanks									0	0	0	0	0	0	0	0	0
Duplicates @ 5%									0	3	3	3	1	3	0	0	0
MS/MSD Samples @ 5%									0	0	3	3	0	0	0	0	0
Rinsate Blanks @ 5%									0	3	3	3	0	0	0	0	0
SEDIMENT SAMPLE TOTAL									0	64	67	67	5	61	0	18	58

NOTES:

1. Laboratory water quality parameters include TSS, TDS, T. hardness, alkalinity.

2. Field measured water quality parameters include pH, dissolved oxygen, temperature, and conductivity.

3. MS/MSD = Matrix spike/Matrix spike duplicate. MS/MSD samples will be collected for explosive and pesticide/PCB analyses, and for ICP, GFAA, and CVAA inorganic analysis. MS/MSD samples will not be collected for analytes which use control-charted USAEC surrogates.

TABLE 5
DESCRIPTION OF SEDIMENT SAMPLE LOCATIONS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

LOCATION	DESCRIPTION	RATIONALE
GRD-94-08X	Mid-area of small pond between two bridges upstream of Grove Pond	To characterize sediment composition in depositional area upstream of pond.
GRD-94-09X (GRW-94-06X)	Immediately downstream of bridge at inlet to Grove Pond	To characterize sediment composition at inlet to pond
GRD-94-10X	Mid-pond approximately 500 feet downstream of bridge	To characterize sediment composition at inlet end of pond
GRD-94-11X	Mid-pond approximately 1,000 feet downstream of bridge	To characterize sediment composition at inlet end of pond
GRD-94-12X	South shore approximately 1,500 feet downstream of bridge and 20 feet from shore adjacent to Town of Ayer Municipal wells	To characterize sediment composition at inlet end of pond and adjacent to Town of Ayer Municipal Wells
GRD-94-13X	Mid-pond approximately 1,500 feet downstream of bridge	To characterize sediment composition at inlet end of pond
GRD-94-14X	North shore approximately 1,500 feet downstream of bridge and 20 feet from shore	To characterize sediment composition at inlet end of pond
GRD-94-15X	North shore approximately 20 feet from shore	To characterize sediment associated with possible fill activities
GRD-94-16X	North shore approximately 20 feet from shore	To characterize sediment associated with possible fill activities
GRD-94-17X	North shore at Pirone Park approximately 20 feet from shore	To characterize sediment associated with possible fill activities
GRD-94-18X	North shore approximately 200 feet from shore	To characterize sediment at approximate mid-point between shore and island
GRD-94-19X (GRS-94-01X)	North shore at Pirone Park approximately 20 feet from shore	To characterize sediment associated with possible fill activities
GRD-94-20X (GRS-94-02X)	North shore at Pirone Park approximately 20 feet from shore in gravel at boat launch	To characterize sediment associated with possible fill activities
GRD-94-21X	North shore at Pirone Park approximately 200 feet from shore at boat launch	To characterize sediment and assess potential sources
GRD-94-22X	North shore at discharge point of intermittent stream west of Pirone Park	To characterize sediment at discharge point of intermittent stream

(continued)

TABLE 5
DESCRIPTION OF SEDIMENT SAMPLE LOCATIONS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

LOCATION	DESCRIPTION	RATIONALE
GRD-94-23X	North shore approximately 20 feet from shore	To characterize sediment and assess potential sources
GRD-94-24X	Northwest cove approximately 20 feet from shore	To characterize sediment and assess potential sources
GRD-94-25X	Northwest cove approximately 10 feet from shore, adjacent to area where wetland/pond was filled	To characterize sediment associated with potential industrial source area
GRD-94-26X	Northwest cove approximately 10 feet from shore, adjacent to area where wetland/pond was filled	To characterize sediment associated with potential industrial source area
GRD-94-27X (GRS-94-03X) (GRW-94-08X)	Northwest cove approximately 10 feet from shore, adjacent to area where wetland/pond was filled	To characterize sediment associated with potential industrial source area
GRD-94-28X	Northwest cove approximately 10 feet from shore adjacent to "native" embankment	To characterize sediment and assess potential sources
GRD-94-29X (GRS-94-04X)	Northwest cove approximately 10 feet from shore at head of smaller cove and adjacent to causeway fill	To characterize sediment and assess potential sources
GRD-94-30X (GRS-94-05X)	Northwest cove approximately 10 feet from shore adjacent to "native" embankment	To characterize sediment and assess potential sources
GRD-94-31X	Northwest cove	To characterize sediment and assess potential sources
GRD-94-32X (GRW-94-09X)	Northwest cove	To characterize sediment and assess potential sources
GRD-94-33X	Northwest cove	To characterize sediment and assess potential sources
GRD-94-34X	Northwest cove	To characterize sediment and assess potential sources
GRD-94-35X (GRS-94-06X)	Along railroad causeway approximately 10 feet from shore	To characterize sediment associated with potential railroad causeway source area
GRD-94-36X (GRS-94-07X)	At corner where railroad causeway meets native material approximately 20 feet from shore in path of potential runoff	To characterize sediment associated with potential railroad causeway source area

(continued)

TABLE 5
DESCRIPTION OF SEDIMENT SAMPLE LOCATIONS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

LOCATION	DESCRIPTION	RATIONALE
GRD-94-37X	Northwest cove	To characterize sediment and assess potential sources
GRD-94-38X (GRS-94-08X)	At point where shore turns from north-south to east-west in path of potential runoff	To characterize sediment and assess potential sources
GRD-94-39X	Along western shore approximately 20 feet from shore	To characterize sediment and assess potential sources
GRD-94-40X (GRS-94-09X)	Along western shore approximately 20 feet from shore	To characterize sediment and assess potential sources
GRD-94-41X	Along western shore approximately 20 feet from shore	To characterize sediment and assess potential sources
GRD-94-42X (GRW-94-10X)	At midpoint of channel connecting southwest cove to main part of pond	To characterize sediment associated with potential railyard source area
GRD-94-43X (GRS-94-10X)	At head of northern lobe of southwest cove approximately 20 feet from shore in path of potential runoff	To characterize sediment and assess potential sources
GRD-94-44X (GRS-94-11X)	At head of southern lobe of southwest cove approximately 20 feet from shore in path of potential runoff	To characterize sediment associated with potential railyard source area
GRD-94-45X	At midpoint of channel connecting southern lobe to southwest cove	To characterize sediment associated with potential railyard source area
GRD-94-46X (GRS-94-12X)	Southwest cove at boat access point approximately 20 feet from shore	To characterize sediment associated with potential Fort Devens source areas
GRD-94-47X	Within narrow inlet equi-distant from three shores	To characterize sediment associated with potential Fort Devens source areas
GRD-94-48X	South shore at boat access point adjacent to Fort Devens Grove Pond water treatment building approximately 20 feet from shore	To characterize sediment associated with potential Fort Devens source areas
GRD-94-49X (GRS-94-13X)	South shore at head of cove on east side of small peninsula approximately 20 feet from shore	To characterize sediment associated with potential Fort Devens source areas

(continued)

TABLE 5
DESCRIPTION OF SEDIMENT SAMPLE LOCATIONS

GROVE POND SITE INVESTIGATION
FORT DEVENS, MA

LOCATION	DESCRIPTION	RATIONALE
GRD-94-50X	Near mid-point of pond approaching northwest cove	To characterize sediment and assess potential sources
GRD-94-51X (GRW-94-07X)	Near mid-point of pond west of island	To characterize sediment and assess potential sources
GRD-94-52X	Near mid-point of pond west of island	To characterize sediment and assess potential sources
GRD-94-53X	North shore approximately 1,000 feet downstream of bridge	To characterize sediment along developed shore
GRD-94-54X (GRS-94-14X)	South shore approximately 500 feet west of Town of Ayer Municipal Wells	To characterize sediment associated with potential Fort Devens source areas
GRD-94-55X (GRS-94-15X)	South shore approximately 500 feet east of Town of Ayer Municipal Wells	To characterize sediment associated with potential Fort Devens source areas

Note:

Collocated surface soil and surface water samples shown in parenthesis.